A BEHAVIORAL SCIENCE APPROACH TO TRANSPORTATION SAFETY*

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OVER the past 18 years my students and I have investigated the application of behavioral science to a variety of societal problems, including litter control, resource recovery, energy conservation, prison management, public health promotion, prevention of drunk-driving. For the past decade much of our applied research has addressed the development and evaluation of strategies to increase the use of vehicle safety belts, and this work is the focus of this presentation.

A personal incident at the LaGuardia Airport last night illustrates the need to continue the development and application of various educational and motivational strategies for safety belt promotion, even after the implementation of a statewide belt use mandate. A limousine driver convinced me and three other individuals who were waiting for a cab to pay his price for a trip to the city. Realizing the small probability of finding workable safety belts in the back seat of the limousine, I selected the front passenger seat where a shoulder strap was clearly visible. However, when pulling the combination lap-shoulder belt across me, I found no receptacle. Indeed, the driver was quick to point out with apparent pride that the receptacles for front and back-seat safety belts were removed in all of the company's limousines three years ago, after the New York buckle-up law was passed. Since occupants of taxi cabs and limousines were exempted from the mandatory belt use law, the removal of all safety belt receptacles in limousines made sense to this driver and to the president of the limousine company. This is obviously an undesirable side-effect of special provisions in the New York law, but more important, this

*Presented in a panel, Behavioral Interventions, as a part of a *Symposium on Motor Vehicle Injuries* held by the Committee on Public Health of the New York Academy of Medicine on December 7, 1987.

The research reviewed here was supported by Centers for Disease Control (Grant R49CCR302635-01), General Motors Research Laboratories, U.S. Department of Transportation (Contracts DTR55681-C-0032, DTR55683-C-00050, and DTNH2285-C-07301), and Virginia Department of Motor Vehicles (Contract DE87-58-53058).

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event illustrates a limiting behavior change effect of the strongest belt use law in the United States.

A belt-use law establishes safety belt use as the social norm, and is certainly a first step toward large-scale increases in safety belt use and prevention of many injuries and fatalities. However, to reach safety belt use levels of 70% or more in the United States, a comprehensive approach to safety belt promotion is necessary.

THE ABC APROACH TO BEHAVIOR CHANGE

The framework we have followed to develop strategies for safety belt promotion is illustrated in Figure 1. Simply stated, a number of antecedent conditions can activate the buckle-up response, and a variety of consequences can increase the desired buckle-up response or decrease the possibility that nonuse of a safety belt will continue. Rewards (or positive reinforcers) are consequences that increase the probability of safety belt use, and activators for announcing the availability of a rewarding consequence for belt use are termed incentives. Consequences used to decrease the probabilty of a given behavior (e.g., the nonuse of a safety belt) are referred to as punishers (or negative reinforcers), and individuals become aware of such punishment contingencies through disincentives.

Activators that do not announce response consequences can take several forms. They may be: signs or words that remind or urge (i.e., prompt) belt use, another individual who demonstrates or models the desired response, or the active signing of a pledge or commitment to evoke the buckle-up response.

BUCKLE-UP REMINDER STICKER

Figure 2 illustrates a reminder sticker available in a variety of formats for display in vehicles. To study the behavioral influence of this simple reminder strategy, Thyer and Geller[1] asked 24 graduate students to record on standardized forms the safety belt use of passengers traveling in the front seat of their vehicles. The data recorders (i.e., vehicle drivers) were required to buckle up on each vehicle trip. After two weeks the 1.5 × 12.5 inch adhesive sticker shown in Figure 2 was fastened to the passenger–side dashboard of the students' 24 automobiles. If questioned by their passengers, the drivers casually replied, "I always prefer that my passengers wear their seat belts." At the end of a two-week intervention period, the dashboard stickers were removed, thereby initiating a two-week withdrawal phase. After two weeks of this condition, the stickers were replaced and data collection continued for

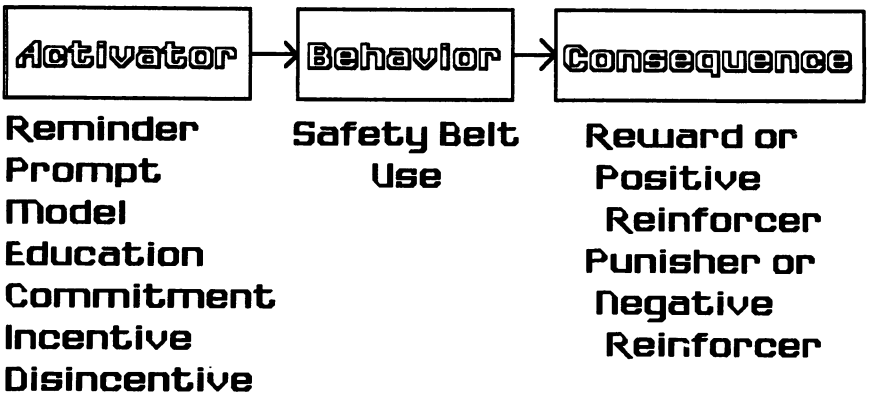

Fig. 1. The "ABC" model for behavior change

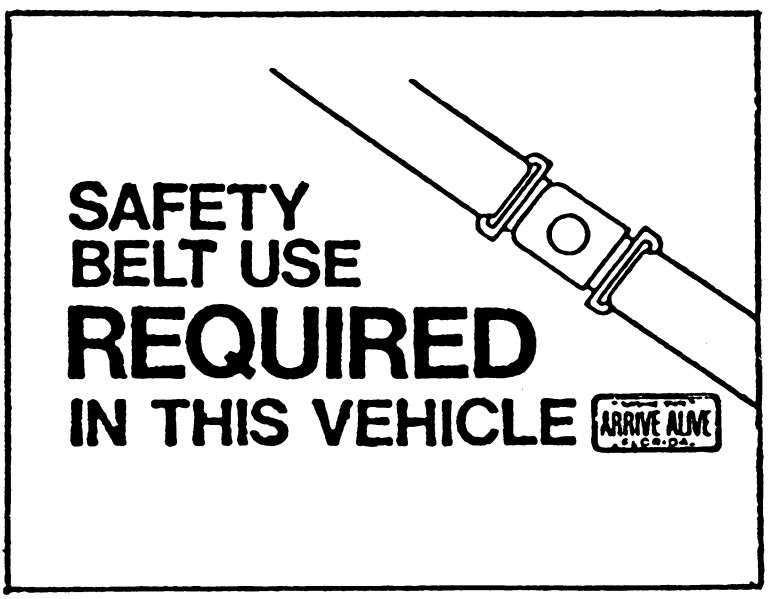

Fig. 2. The 1.5″×2.5″ dashboard reminder sticker evaluated by Thyer and Geller.[5] Reproduced by permission from Thyer, B.A. and Geller, E.S.: The "buckle up" dashboard sticker: An effective environmental intervention for safety belt promotion. *Envir. Behav. 19*:489, 1987.

a second two-week intervention period.

Figure 3 depicts the results of our dashboard-sticker study, showing prominent effects of this reminder strategy. The data points for the first two-week baseline represent 476 passengers with a mean belt use rate of 34%. Then,

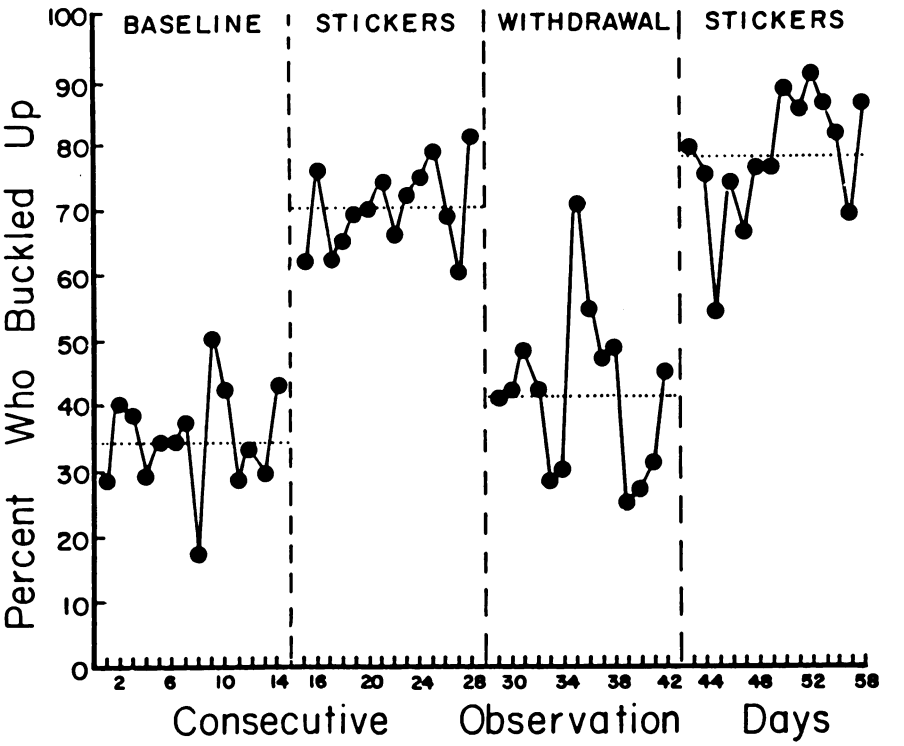

Fig. 3. The percentage of vehicle passengers who buckled up before and after the buckle-up reminder stickers were applied.[5]

during the first intervention period, mean safety belt use increased to 70% among 448 passengers. Subsequently, when the stickers were removed, passenger belt use dropped to 41% of 406 passengers, and rose again to 78% of 392 passengers when the reminder stickers were replaced.

Safety Belt Reminder Systems

Over the years, a variety of buzzer-light reminder systems have been included in motor vehicles in an attempt to prompt safety belt use. Most intrusive was the buzzer that sounded until the front-seat belts were buckled. These systems, as well as the ignition interlock contingency that required front-seat belts to be buckled in order to start the vehicle, were undermined by most vehicle owners by either disconnecting the buzzer or by sitting on a buckled belt.[2]

The buzzer-light reminders in current automobiles are least intrusive, consisting of only a panel light and a pleasant chime initiating when the ignition key is turned and terminating in 4 to 8 seconds or earlier if front-seat belts are

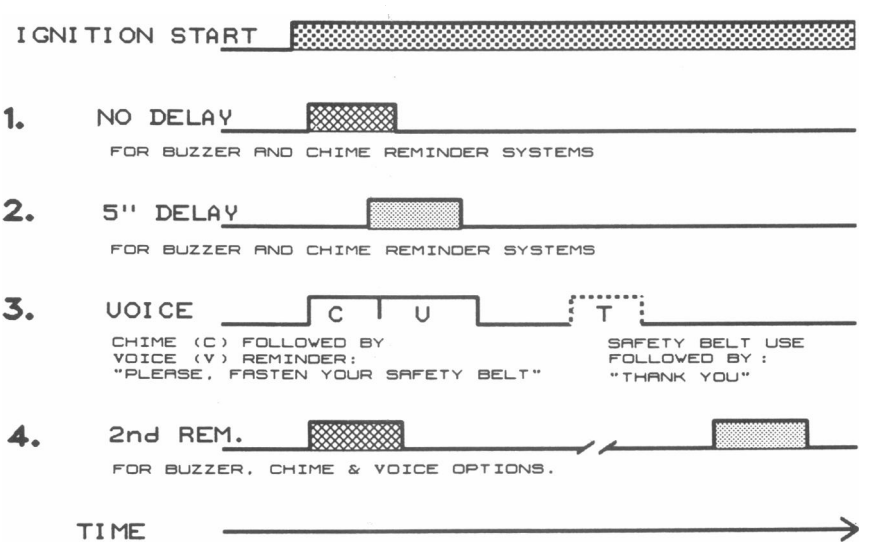

Fig. 4. The possible temporal arrangements for the safety belt reminder systems evaluated by Berry and Geller.[24]

buckled. If the driver starts the automobile before buckling up, which was the case for about 50% of our observations of 1,492 drivers[3], it is not possible to avoid the reminder buzzer. Thus, a buzzer-light reminder might be more effective if its initiation is delayed after a vehicle is started, thus giving the driver an opportunity to buckle up before the buzzer sounds. Our field observations showed that the average driver takes about 3 to 4 seconds to buckle up,[3] and this information has been applied in our ongoing study of safety-belt use under a variety of reminder systems.

Figure 4 depicts the temporal arrangements for different reminder systems under study by one of my students. More specifically, General Motors Research Laboratories has loaned us a 1984 Cadillac which can provide any of the following reminder systems: the standard 4 to 8 second buzzer or chime that initiates upon engine ignition; a 4 to 8 second buzzer or chime that initiates 5 seconds after ignition; a voice reminder (''Please Fasten your Safety Belt'') that initiates 5 seconds after engine ignition and offers a ''thank you'' after the driver's belt is buckled; and a second reminder option whereby the 4 to 8 second buzzer, chime, or verbal prompt is initiated if the driver is not buckled when the vehicle makes its first stop after exceeding 10 miles per hour. This special vehicle has a portable computer in its trunk to record each instance of belt use by the driver.

We have been studying the impact of these different reminder systems by having college students drive the experimental vehicle on a planned community course under the auspices of an energy conservation study. The subject is required to stop and park the vehicle at six specific locations along this two-mile course and flip a toggle switch in the vehicle's trunk. This gives the driver six opportunities to buckle up during a one-hour experimental session. Each subject returns periodically to participate in this so called "energy conservation study", the number of days between sessions varying from one to five. Results are examined on an individual basis in an attempt to show functional control of a particular reminder system.

Up to this point, Thomas Berry has run 30 subjects with this paradigm and the findings can be summarized as follows: delaying the buzzer 5 seconds after engine ignition had no notable impact; the vocal reminder in lieu of the buzzer or chime increased belt use in 3 out of 5 cases; a second reminder effectively increased the belt use of 2 out of 7 subjects; and most of the subjects (25 out of 30) showed no consistent behavior change as a result of the reminder intervention.

Figures 5, 6, and 7 depict the results of individual subjects that illustrate the research conclusions given above. Figure 5 shows a subject who did not buckle up on 12 occasions when the buzzer was delayed 5 seconds after engine ignition. However, when the second reminder system was instigated, this subject buckled up on 8 out of 12 occasions. Functional control was demonstrated because the subject's belt use dropped to the zero baseline after the second reminder was removed.

Figure 6 illustrates marked effects of the vocal reminder and "thank you" consequence. With the standard, no delay buzzer, the subject/driver never buckled up (i.e., for 48 opportunities). However, this subject used the safety belt on every trip when the vocal reminder was in effect. This behavior change followed exactly the alternating experimental conditions (i.e., an ABAB design), illustrating clear functional control by the vocal safety belt reminder system. In contrast, Figure 7 depicts prominent failure of the vocal reminder for another subject. This subject buckled up the first time she got into the Cadillac, but never buckled up again in the experimental vehicle. Indeed, on 42 opportunities to buckle up she heard 60 "buckle up" reminders (counting the two reminders she received on 18 occasions of the second-reminder condition).

Thus, our buckle-up reminder research has shown varying reactions to the different safety belt reminder systems. Some individuals can be expected to resist even the most salient reminder system (e.g., Figure 7) while for other

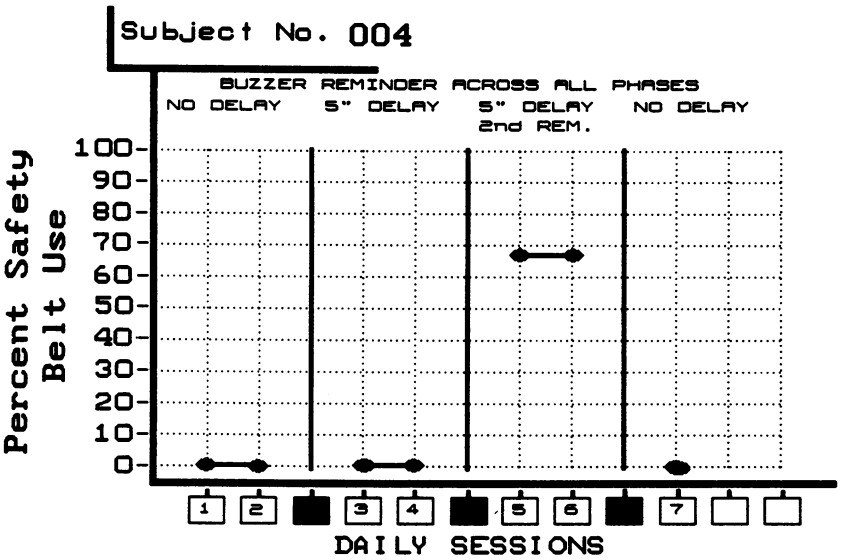

Fig. 5. Safety belt use data of a representative subject who was influenced by the second reminder.[24]

drivers only a second buzzer reminder is sufficient to increase safety belt use.

THE AIRLINE LIFESAVER

The "Airline Lifesaver" is another reminder approach for promoting safety belt use, which I developed and began implementing in November 1984. This technique merely requires an individual boarding an airplane to hand cards that contain the message illustrated in Figure 8 to the airline flight attendants and/or the pilot. Reminding airline passengers to buckle up during their ground transportation is certainly consistent with the airline requirement that passengers buckle up during air travel, and may even be instrumental in increasing belt use in a few cases. Once I observed a lady request the driver of an airport bus to buckle up (which she did), and when I commended this person on her "safety assertiveness", she explained, "I heard a buckle-up message on the airplane, and figured if the stewardess can request seat belt use, so can I."

Figure 9 illustrates the compliance record of airline attendants regarding the announcement request. For the 230 air trips I took (from November 1984 until April 1987), the "Airline Lifesaver" was effective in prompting the buckle-up announcement on 35.2% of the occasions. My success with the

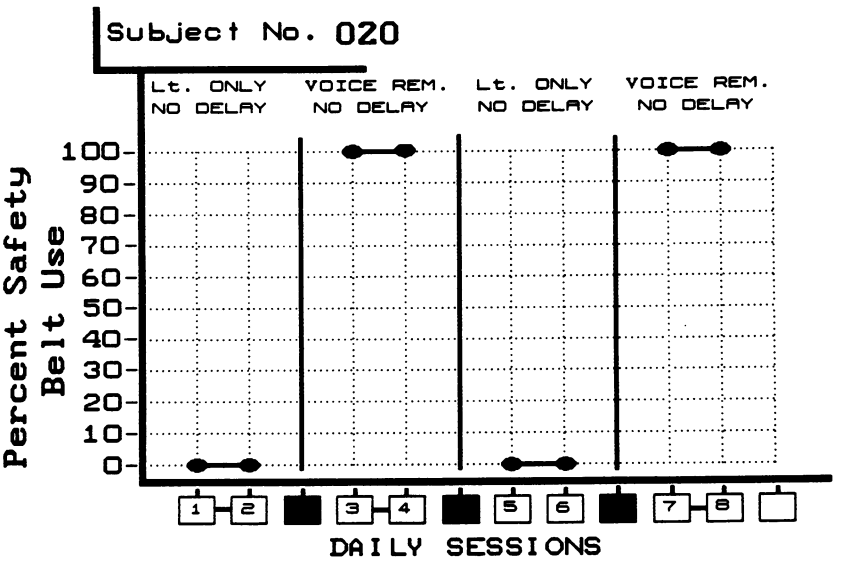

Fig. 6. Safety belt use data of a representative subject who was influenced by the voice reminder system.[24]

"Airline Lifesaver" has continued at essentially the same rate, although some of my colleagues have reported greater compliance. Figure 9 displays the compliance rates reported by the employees at one agency (The Alaska Prevention Council) and by three colleagues. Obviously, the direct buckle-up impact of the "Airline Lifesaver" would be difficult or impossible to assess, but it is safe to assume that the beneficial large-scale effect of this activator is a direct function of the number of individuals who deliver the reminder card to airline personnel. In this regard, it is encouraging that several large organizations (e.g., Air Products of Allentown, Pennsylvania, Ford Motor Company, and Tennessee Valley Authority) have made "Airline Lifesaver" cards available to their employees. If the delivery of an "Airline Lifesaver" card does not result in a buckle-up message, or if the airline reminder does not influence a single airline passenger to use a safety belt during ground transportation, the act of handing an "Airline Lifesaver" card to another individual should at least increase the card deliverer's commitment to personal safety belt use. Beneficial effects of involvement in safety belt promotion was also possible with another reminder strategy—the "Flash for Life".

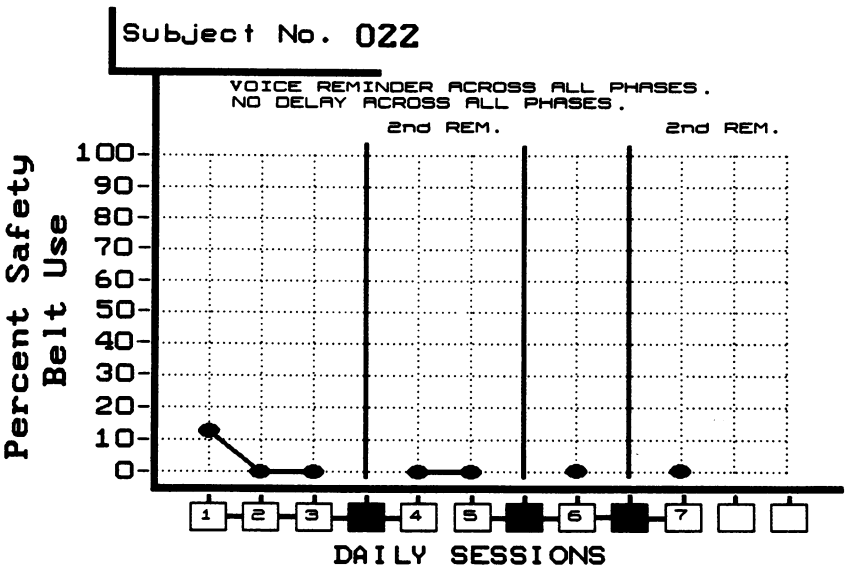

Fig. 7. Safety belt use data of a subject who was not influenced by the voice reminder, even when it occurred as a second reminder.[24]

THE FLASH FOR LIFE

The "Flash for Life" approach to safety belt promotion requires that a person displays to vehicle occupants the front side of an 11 × 14 inch flash card that reads, "Please buckle up—I care." If the vehicle occupant looks at the card and then buckles up, the flasher flips over the card to display the bold message, "Thank you for buckling up." (See Figure 10 for an illustration of the front and back of this "Flash for Life" card.) For the first evaluation of the intervention strategy,[4] the flasher was the front-seat passenger of a stopped vehicle and the flashee was the driver of an adjacent, stopped vehicle. Observers in the back seat of the flasher's vehicle recorded the reactions to this intervention.

The flash card was shown to 1,087 unbuckled drivers, and of these 82% looked at the flash card. Of those who looked at the flash card, 22% complied with the buckle-up request on-the-spot. Compliance was not influenced by the age or gender of the flashee (young child or college student), nor by the gender of the driver. However, significantly ($p<0.05$) more drivers in the university town of Blacksburg, Virginia, buckled up following the flash card presentation (25% mean compliance) than in the adjacent rural town of Christiansburg (14% mean compliance).

Another application of the "Flash for Life" card was shown by Thyer,

Fig. 8. The 4″×5 1/2″ Airline Lifesaver card used to prompt flight attendants to remind passengers to buckle up during ground transportation.

Geller, Williams, and Purcell.[5] College students, posted at the entrance/exit areas of campus parking lots, used the flash card to remind unbuckled vehicle occupants to use their belts and to thank those who were already buckled up or who buckled after being reminded. By alternating baseline and intervention conditions each week in an ABAB design, these investigators demonstrated significant functional control of the flash card. More specifically, mean safety belt use by vehicle drivers increased from 19.5% (n=629) during the initial baseline to 45.5% (n=635) during the first flash card phase. Then, mean belt use decreased to 28.5% (n=634) when the intervention was withdrawn, but increased to 51.5% (n=625) when the reminder intervention was reintroduced.

Actually, involving people in flashing for safety belt promotion might produce the most lasting benefits of this intervention. For example, my daughter's involvement in this sort of flashing at the age of 3½ has helped to "value-program" her for vehicle safety. Not only is she the first in our car to

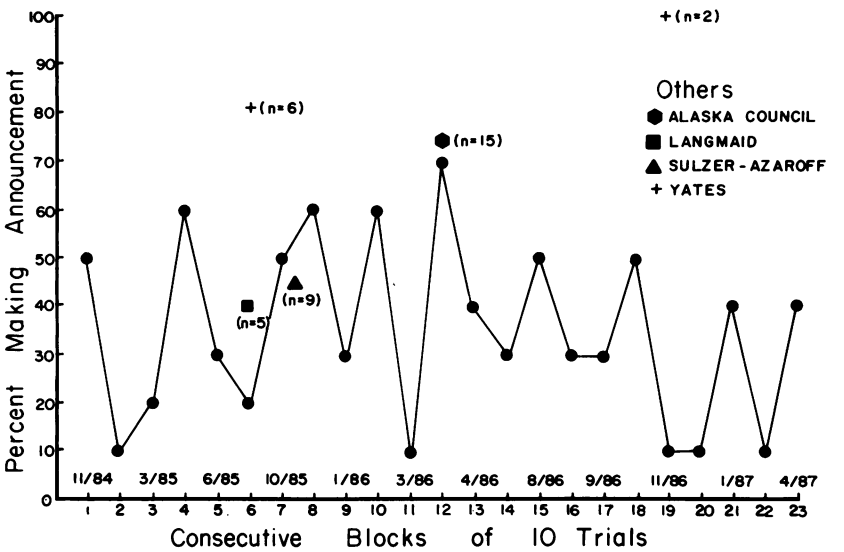

Fig. 9. The percentage of flight attendants complying with the Airline Lifesaver request over consecutive blocks of ten flights from November 1984 until April 1987.

buckle up and to remind others to do the same, she also monitors the speedometer and admonishes her parents when they exceed the posted speed limit. Thus, it has been my pleasure to honor more than 3,000 requests for "Flash for Life" cards.

T.V. Modeling

Modeling refers to the actual demonstration of specific behaviors, and has marked effects on the behaviors of observers.[6] This activator can teach an observer new behavior patterns, increase the occurrence of already learned behaviors, or decrease the frequency that certain behaviors will be emitted. For example, when television stars buckle up, some viewers learn how to put on a safety belt, others are reminded that they should buckle up on every vehicle trip, and others realize that safety belt use is an acceptable social norm. On the other hand, the frequent nonuse of safety belts on television creates the attitude that certain types of individuals (e.g., macho males or attractive females) do not use safety belts.

Our systematic observation and analysis of safety belt use on television over the past three seasons (i.e., 1984, 1985, 1986) has shown disappointingly low rates of safety belt use on the prime time action shows of the major networks. However, there has been steady improvement. Table I summarizes

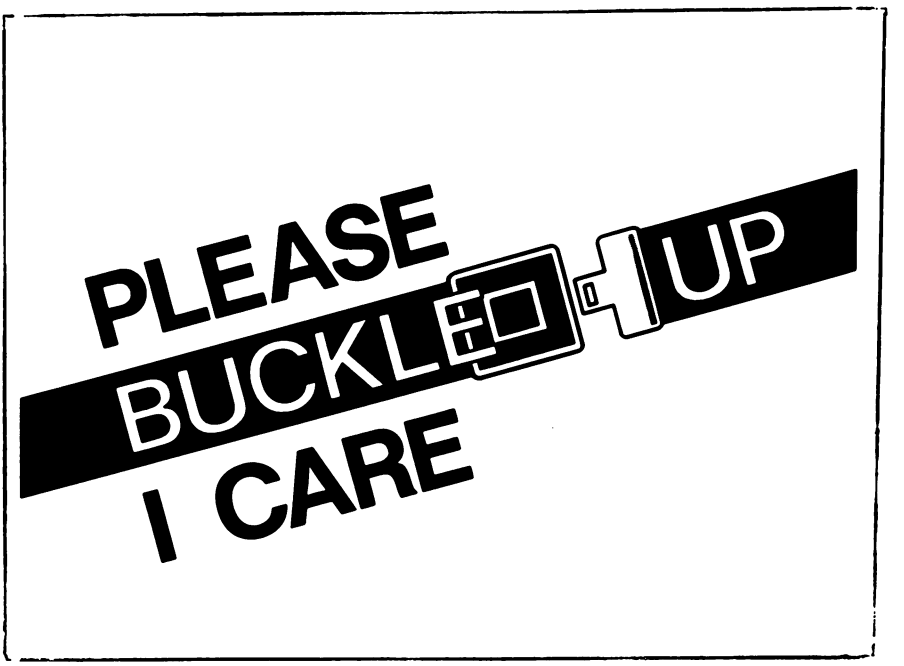

Fig. 10. The front and back of the 11″×14″ "Flash for Life" card, which is brightly colored in yellow, black, and white. Reproduced by permission from Thyer, B.A., Geller, E.S., Williams, M., and Purcell, E.: Community based "flashing" to increase safety belt use. *J. Esp. Educ. 55:*156, 1987.

the results of our observations of 5,544 total driving scenes across 538 episodes of 21 different prime time television shows. The overall rate of safety belt use on television has doubled over the past three years (from 8% in 1984 to 17% in 1986), consistent with changes in national belt use statistics. It is unfortunate that the medium has only reflected the unsafe driving practices of the general public, rather than attempting to model safe behavior and set appropriate standards.

Figure 11 shows that one macho television character (i.e., T.J. Hooker) did model appropriate belt use in 1984, and was responsible for giving ABC the relatively high belt use statistics that year (see Table I). Encouraging also was the prominent increase in safety belt use from 1985 to 1986 by MacGyver (0% to 52% belt use) and Spenser (0% to 30% belt use). The prominently low use of safety belts by Colt (''Fall Guy'') in 1984 and 1985 is quite disappointing and unrealistic, since this character played the role of a stunt driver. The drivers who performed the vehicle stunts on this show obviously wore a safety harness on every trip.

Figure 12 depicts the belt use of two macho characters from CBS. The older and wiser Equalizer has used a safety belt significantly more often than the younger PI—Magnum. Figure 13 shows a marked increase in safety belt use by a very macho television hero—Mr. T of The A-Team. Mr. T's unusually high rate of safety belt use in 1985 (up from no belt use in 1984) was very noticeable on the show, since he was the only member of his A-Team to buckle up that year. During the 1986 season, however, his colleagues were often seen using their safety belts.

The dramatic change in Mr. T's belt use behavior may have been partly due to a nationwide campaign that my students and I initiated in 1984 to bring public attention to the inappropriate nonuse of safety belts by television stars. We circulated a petition throughout the United States that described the presumed detrimental modeling effects of low safety belt use on television, and received approximately 50,000 signatures from 36 states. Subsequently we distributed a list of 30 names and addresses of television stars along with instructions to write letters requesting safety belt use by those who don't buckle up and to write ''thank you'' notes to those who already buckle up on television. As a result of a special creative writing campaign in 1984, more than 800 third and fourth grade students in Olympia, Washington, wrote a buckle-up request to Mr. T. Our campaign received substantial media attention, including a spot on ''Entertainment Tonight.''

TABLE 1. SAFETY BELT USE FOR PRIME TIME NETWORK SHOWS: DURING THE 1984, 1985, AND 1986 SEASONS

	1984 season			*1985 season*			*1986 season*		
Network	*Episodes*	*Driving scenes*	*Belt use*	*Episodes*	*Driving scenes*	*Belt use*	*Episodes*	*Driving scenes*	*Belt use*
ABC shows									
Fall guy	12	163	13%	7	222	0%	—	—	—
Hardcastle & McCormick	15	155	3%	11	110	39%	—	—	—
T.J. Hooker	11	149	47%	—	—	—	—	—	—
Matt Houston	12	99	2%	—	—	—	—	—	—
MacGyver	—	—	—	11	64	3%	4	41	34%
Moonlighting	—	—	—	12	54	37%	4	27	81%
Spenser	—	—	—	3	13	0%	3	61	28%
ABC Totals	50	566	17%	44	463	14%	11	129	42%
CBS shows									
Cagney & Lacey	—	—	—	10	36	39%	6	38	42%
Dukes of Hazard	15	413	0%	—	—	—	—	—	—
Equalizer	—	—	—	14	102	14%	6	30	20%
Magnum PI	15	74	0%	6	34	0%	11	145	11%
Scarecrow & Mrs. King	14	118	16%	12	74	26%	5	60	15%
Simon & Simon	18	143	0%	22	148	2%	6	51	29%
CBS Totals	62	748	3%	64	394	13%	34	324	19%
NBC shows									
A-Team	18	236	1%	15	139	20%	6	62	39%
Helltown	—	—	—	6	47	2%	—	—	—
Highway to Heaven	—	—	—	12	55	0%	6	26	0%
Hill Street Blues	13	71	0%	12	46	13%	10	58	3%
Hunter	13	133	7%	9	103	38%	12	136	38%
Miami Vice	17	112	0%	13	71	0%	16	192	3%
Remington Steele	18	104	2%	13	87	0%	—	—	—
Riptide	14	123	20%	11	73	37%	—	—	—
NBC Totals	93	779	5%	91	621	16%	50	474	18%
Overall	205	2,093	8%	199	1,478	15%	95	927	22%

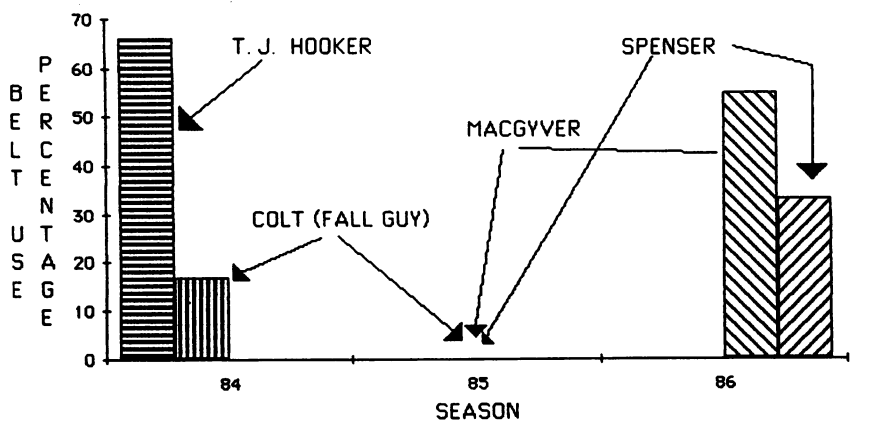

Fig. 11. The rate of safety belt use by certain "macho" TV stars on ABC during the 1984, 1985, and 1986 seasons.

EDUCATION

Activities in educational settings are activators which can certainly influence behavior change. Since vehicle crashes are the leading killer of school-aged children, and since early educational experiences can leave lasting impressions, it seems imperative to teach the hows and whys of safety belt use in primary school. The challenge is to develop and apply optimal teaching/learning techniques for safety belt promotion among children. Our current research in this regard, funded by the Centers for Disease Control, has been guided by the Confucian principle, "Tell them and they'll forget, demonstrate and they'll remember, involve them and they'll understand!"

Our development of a cost-effective curriculum for safety belt promotion among children began as the dissertation research of Galen R. Lehman, who wrote a short skit about a child called "Buckie Buckle" who always uses his safety belt. "Buckie Buckle" rides in a car at different times with his father, mother, grandpa, grandma, and cousin. With each of these drivers, a scenario is given whereby Buckie buckles up and affirms, "I love my buckle buckled." The driver gives one of the standard excuses for not using a safety belt and is subsquently injured when the vehicle crashes. At several points in the skit, key phrases such as, "I love my buckle buckled" are repeated by child participants.

After observing unobtrusively the front–seat safety belt use of children and parents in the parking lot of a Montessori school for five days, the preschool children (aged 3 to 5) practiced the "Buckie Buckle" play for a week and then presented the 10 minute skit to their parents. Three days later the chil-

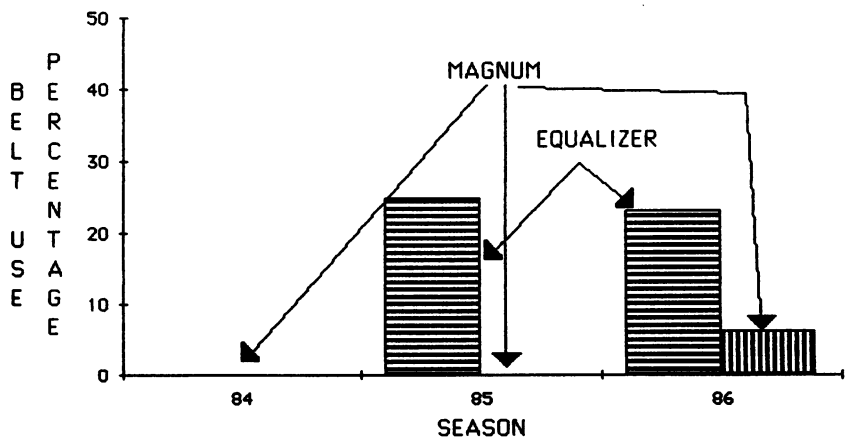

Fig. 12. The rate of safety belt use by certain "macho" television stars on CBS during the 1984, 1985, and 1986 seasons.

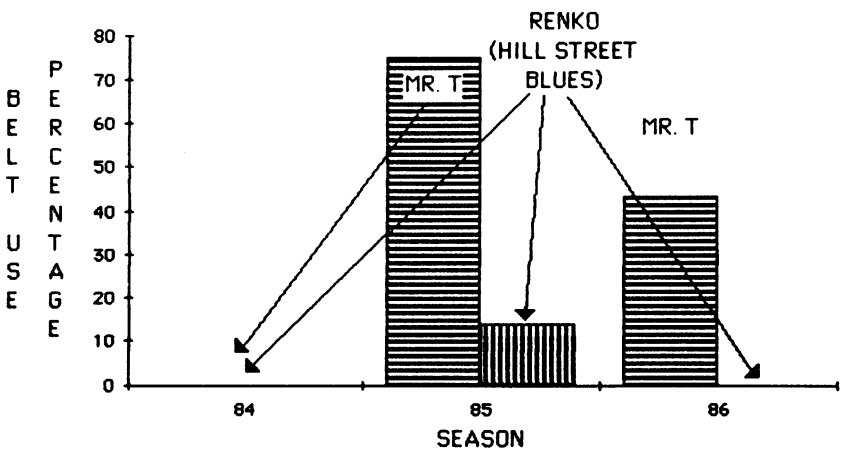

Fig. 13. The rate of safety belt use by certain "macho" television stars on NBC during the 1984, 1985, and 1986 seasons.

dren presented the same skit to the 18 children attending the primary classes of the school. During this intervention period (5 days), we observed unobtrusively the safety belt use of front-seat occupants when vehicles entered and exited the school's parking lot. Then we returned three months later for five consecutive days of follow-up observation.

By recording vehicle license plate numbers, we were able to track the safety belt use of individual children and their parents throughout the three

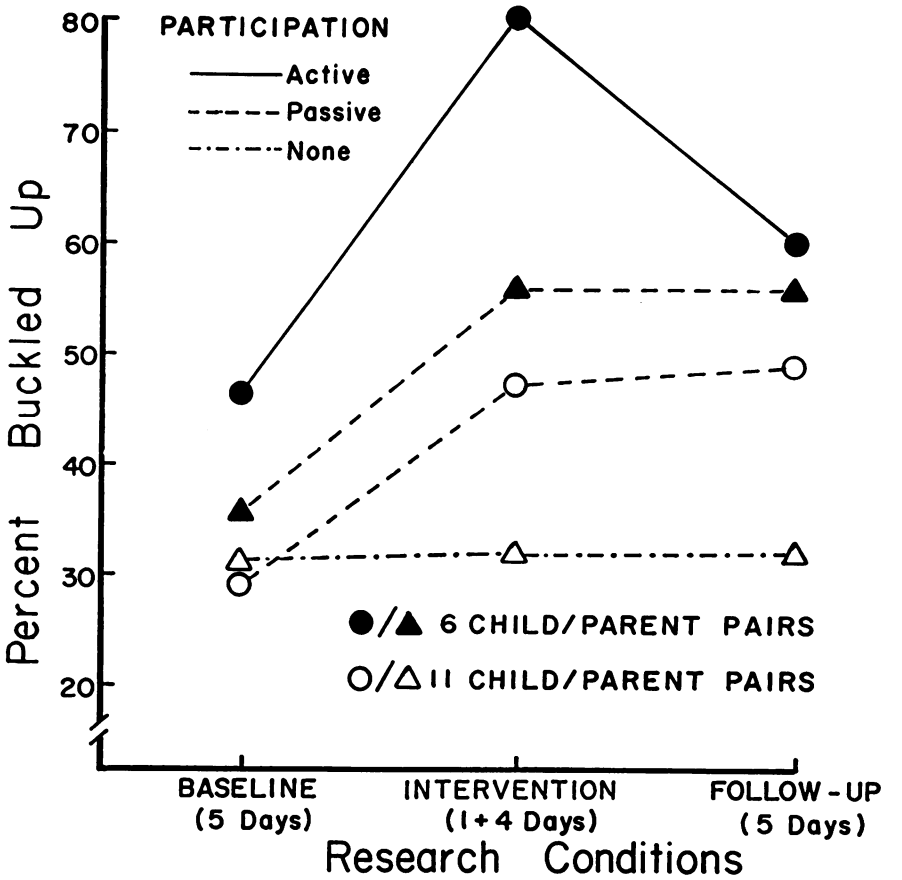

Fig. 14. The percentage of Montessori children and their matched parent drivers who buckled up during baseline, after an active education program for preschoolers and passive education for primary school children and the parents of preschoolers, and during follow-up (i.e., three months after the intervention).

phases of this study (baseline, intervention, and follow–up). Figure 14 depicts the safety belt use of matched child-parent pairs whom we observed on at least three occasions during each phase and who were not seen buckled up on every occasion. During baseline, the preschool children were observed buckled up most often, perhaps because they most recently rode in child safety seats. These children also showed the greatest increase in safety belt use during the intervention period, presumably because they were active participants in the "Buckie Buckle" skit. This dramatic increase did not continue into the follow-up phase, possibly because of the lack of supportive modeling by parents.

The passive participants (i.e., the parents of the preschoolers and the children in the primary classes) showed equivalent increases in safety belt use during the intervention phase and maintained this increase three months later. The parents of the primary school children received no intervention and therefore served as a control group. Since these subjects did not change their safety belt use throughout the study, functional control of the intervention is indicated.

We are currently analyzing the results of another intervention that we implemented with only the primary students in this school. This intervention involved the children in signing a buckle-up pledge card and in recording daily the use or nonuse of safety belts by all vehicle occupants during arrival and departure from school. We expect this intervention to increase the belt use of both children and their parents.

COMMITMENT

Signing a "buckle-up" pledge results in a commitment antecedent to behavior change. This is an activator which we have found to increase safety belt use significantly.[7,8] This study was a long–term and large–scale investigation conducted on a university campus with 22,000 students. During the Spring and Fall academic quarters, buckle-up pledge cards were available throughout the campus (10,000 in the Spring and 18,000 in the Fall). Signing this pledge card implied a commitment to use vehicle safety belts for an entire academic quarter and returning the lower portion of the pledge card (see Figure 15) to conveniently located raffle boxes enabled entry into weekly random drawings of prizes donated by local merchants. Hanging the upper portion of the pledge card from the vehicle's inside rearview mirror served as a reminder of a commitment to buckle up.

By requesting pledge card signers to write their vehicle's license plate numbers on the pledge cards and by recording vehicle license numbers during systematic observation of campus safety belt observations, it was possible to dichotomize the belt observations according to whether the driver had signed a pledge card. Since parking decals were also recorded during belt audits, it was possible to categorize the belt use data according to whether the vehicle was faculty/staff or student.

Figure 16 displays the percentage of faculty/staff and students buckled up during successive phases of this study. During each phase, faculty/staff drivers buckled up significantly more often than students ($p<0.01$), and those who signed a buckle-up pledge were always more apt to use a safety belt than those who did not ($p<0.01$). Functional control of the commitment interven-

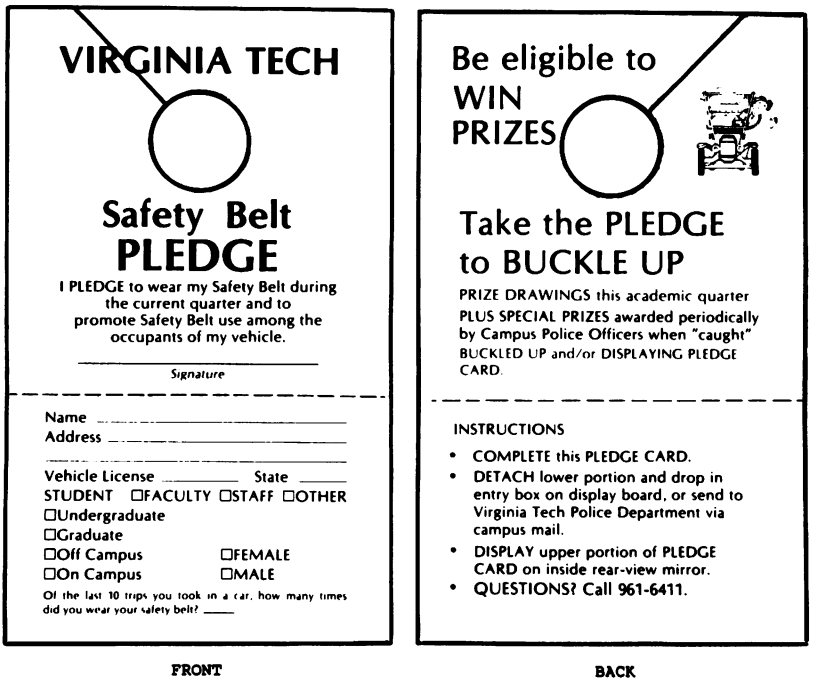

Fig. 15. The front and back of the 4″×5″ pledge cards that were distributed for the universitywide "Pledge Card Sweepstakes".[7]

tion is shown in Figure 16 by the prominent increase in belt use for only the "pledgers" on the two occasions when the "lottery" was introduced (i.e., Spring 1985 and Fall 1985). Across both the Spring and Fall pledge card lotteries, faculty/staff pledgers (n=208) went from a high prepledge belt use level of 56.4% to a post-pledge level of 75.9%, and students who signed pledge cards (n=252) increased their belt use from a pre-pledge use of 49.3% to a postpledge level of 69.8%.

INCENTIVES AND DISINCENTIVES

Announcing the availability of a reward for safety belt use is an activator termed an incentive, whereas announcing that the nonuse of a safety belt can result in a monetary fine is considered a disincentive activator. Research has shown quite dramatically that the impact of a legal mandate (e.g., safety belt use law) varies directly with amount of media promotion (i.e., the disincentive). The success of the campus pledgecard program described above depended upon making faculty, staff, and students aware of the possible rewards for turning in signed pledge cards. This promotion aspect of the

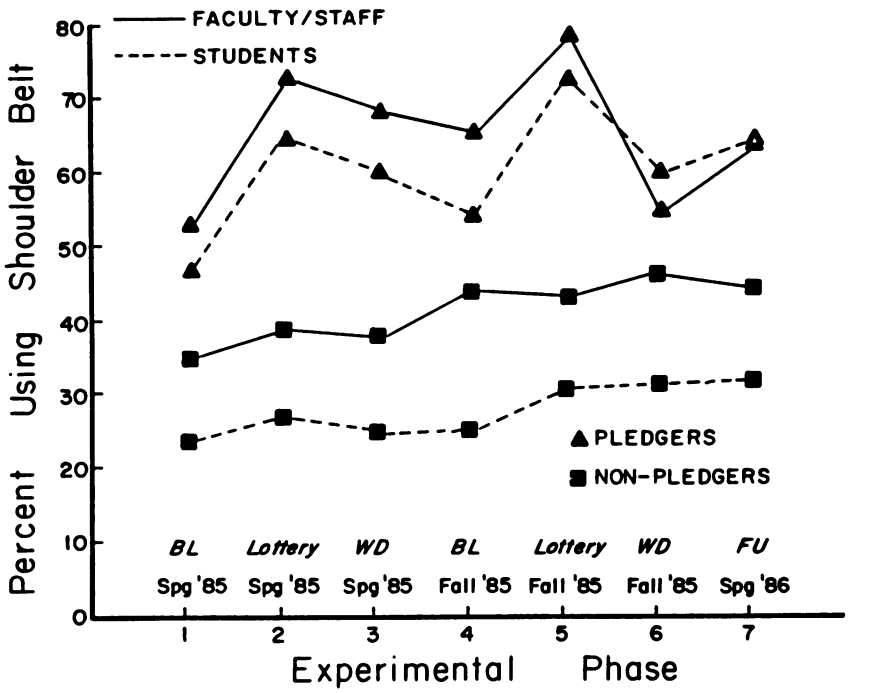

Fig. 16. Percentage of pledge card signers and nonsigners among university students and faculty/staff who were observed using safety belts during certain experimental conditions from Spring 1985 until Spring 1986.[7]

program was an incentive, whereas delivering prizes to raffle winners was a rewarding consequence, contingent upon a pledge card being selected during weekly raffles.

Rewarding Consequences

Promoting safety belt use by rewarding individuals for signing a buckle-up pledge card has been termed an *indirect* reward strategy, in contrast to the *direct* approach whereby individuals are rewarded directly for using a safety belt.[9,10] Direct rewards are immediate consequences when vehicles are stopped and occupants are rewarded on the spot for being buckled up. On the other hand, vehicles with occupants using safety belts can be identified (e.g., by recording license plate numbers), and the occupants can be contacted later to receive rewarding consequences for being buckled up. This is a *direct* and *delayed* reward strategy.

Considering basic learning theory, the direct and immediate approach should be most effective at increasing safety belt use, and the indirect re-

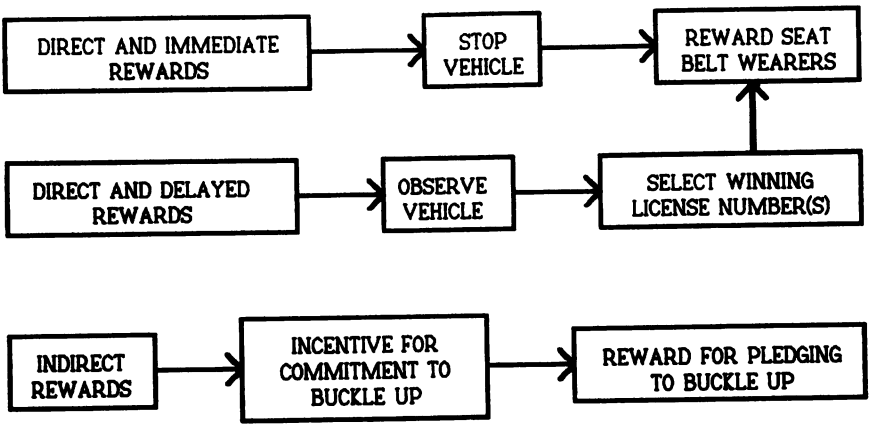

Fig. 17. The three different strategies for administering rewards to promote safety belt use.

wards should be least effective. However, our review of the literature[9,11] and comparative research[12] has generally shown these reward strategies to be equally effective at motivating the use of vehicle safety belts. Figure 17 reviews these three approaches to applying rewarding consequences for safety belt promotion.

A Direct and Immediate Program

The safety belt program that received the most extensive behavior analysis occurred at the Radford Army Ammunition plant, which employed 3,023 workers at the time.[13] At the main entrance/exit gate manned by two uniformed security officers, safety belt use and vehicle license plate numbers were recorded before (18 days), during (30 days), and after (30 days) an incentive/reward contingency was implemented during workers' afternoon departure from the plant. During the incentive/reward intervention, drivers who were buckled up were handed an incentive flier with one side as depicted in Figure 18. The back of the flier contained the logos of the 25 community merchants who donated prizes for the "Combination Game." Drivers who were not buckled up were given a flier with "void" printed over the symbol in the center of the belt buckle (see Figure 18). Also, a slip of paper was stapled to the bottom of these fliers which read, "Next time wear your seat belt and receive a chance to win a valuable prize!"

Safety belt use increased from baseline means of 20.4% and 17.3% during the morning and afternoon, respectively, to means of 31.1% during morning

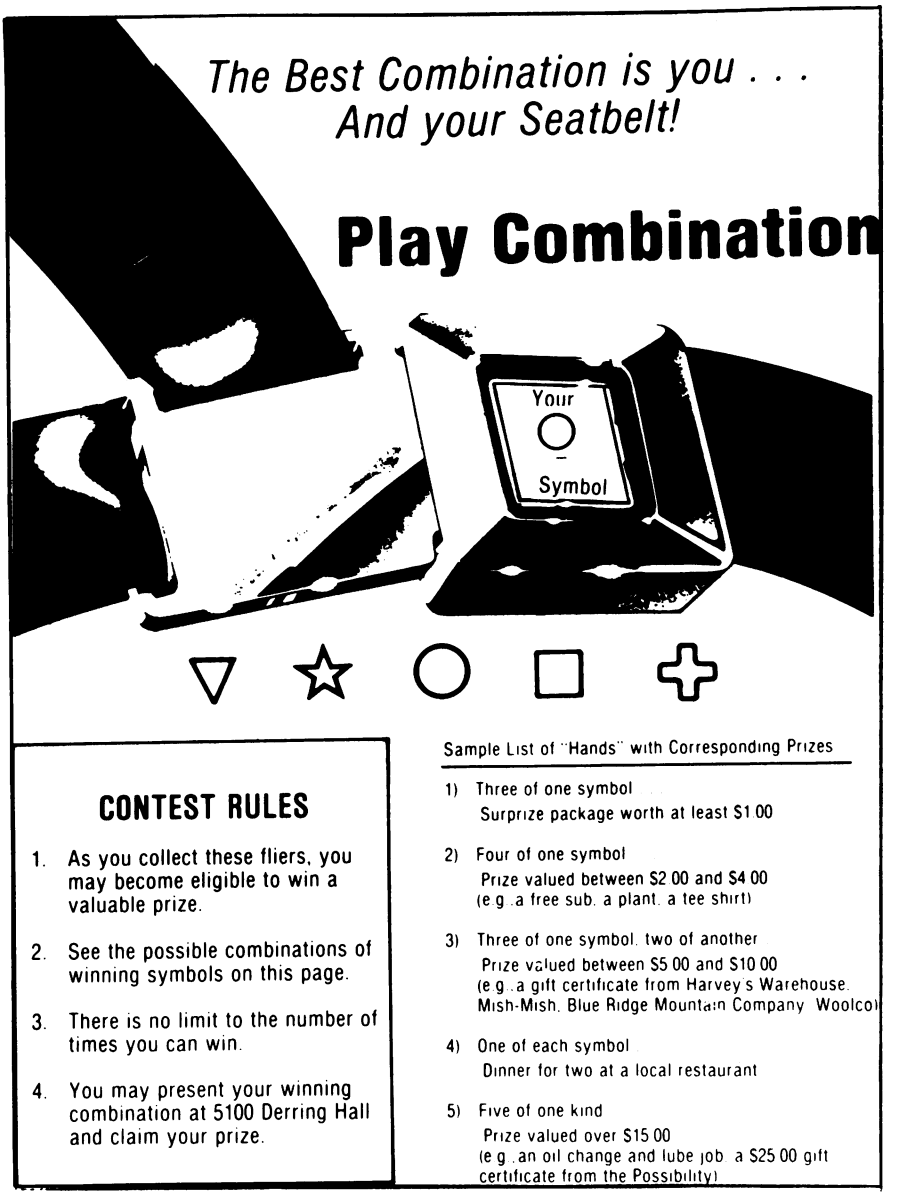

Fig. 18. The incentive flier used in the direct and immediate reward program at Radford Army Ammunition Plant.[13]. Reproduced by permission from Geller, E.S., Paterson, L., and Talbott, E.: A behavioral analysis of incentive prompts for motivating seat belt use. *J. Appl. Behav. Anal. 15*:406, 1982.

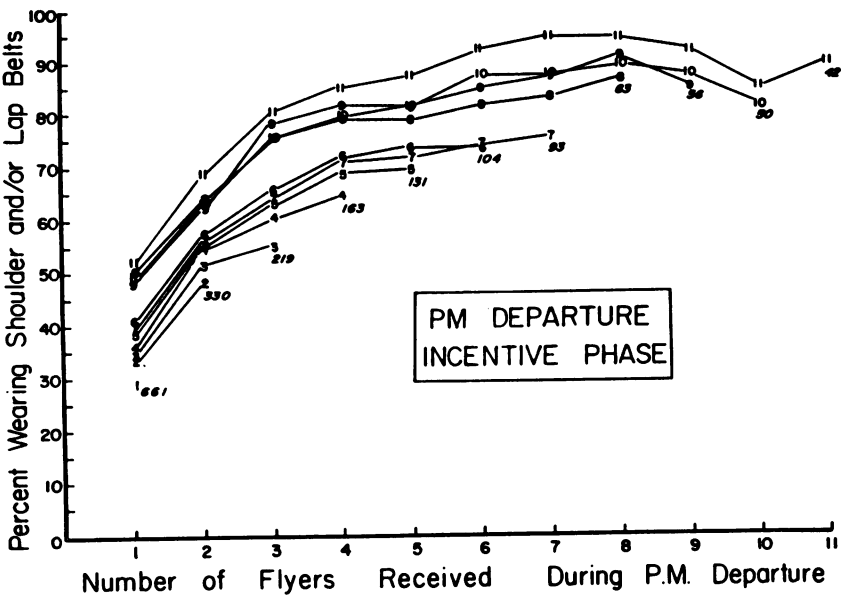

Fig. 19. Percentages of shoulder and/or lap belt wearers for afternoon departures during the incentive program at Radford Army Ammunition Plant as a function of frequencies of incentive flyers received.[13] Reproduced by permission from Geller, E.S.: Rewarding safety belt usage at an industrial setting: Tests of treatment generality and response maintenance. *J. Appl. Behav. Anal. 16*:195, 1983.

arrivals and 55.5% during afternoon departures when the incentive fliers were distributed. During follow-up, mean belt use dropped almost to baseline levels. Categorizing vehicles according to license plate number and driver gender enabled a detailed behavior analysis of individual safety belt use.

Figure 19 displays the percentage of individuals buckled up during afternoon departure from the plant as a function of the number of incentive fliers received (i.e., fliers with and without a valid reward symbol). The numbers used for data points in the figure represent the frequency of total fliers received for the sample, and the number at the end of each line represents the number of drivers in the particular experience category. For example, 93 drivers received 7 fliers, and with each successive flier receipt up to four the belt use of this group increased. Actually, this was the pattern for each exposure group. In other words, safety belt use had essentially reached peak levels at the point when the fourth flier was distributed. If drivers had not been motivated to buckle up (and receive fliers with valid reward symbols) after receiving their third invalid incentive flier, additional fliers had minimal influence.

Figure 20 depicts the percentage of drivers buckled up during morning

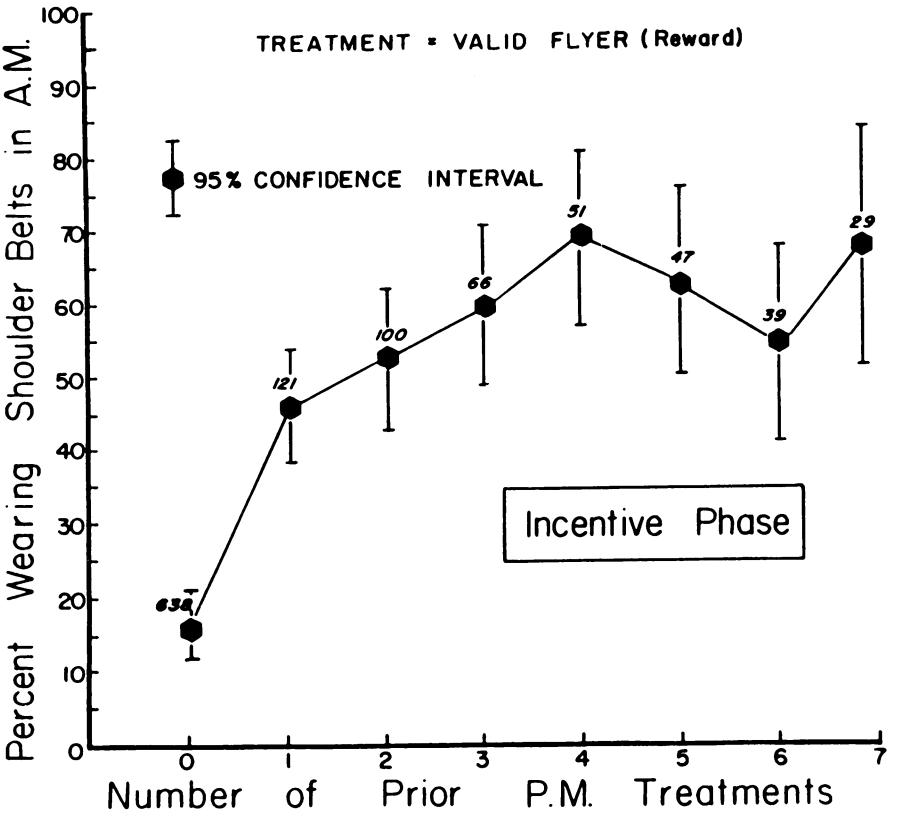

Fig.20. Shoulder belt use during morning arrival at Radford Army Ammunition Plant as a function of number of program flyers received in the afternoon.[13] Reproduced by permission from Geller, E.S.: Rewarding safety belt usage at an industrial setting: Tests of treatment generality and response maintenance. *J. Appl. Behav. Anal. 16*:197, 1983.

arrivals (when incentive fliers were distributed in the afternoon) as a function of the number of prior incentive fliers received in the afternoon with a valid reward symbol (i.e., the driver was buckled up). The function shows a consistent increase in morning belt use as a function of the first four afternoon rewards for belt use. These data suggest that some drivers who were motivated to use their safety belts during the afternoon distribution of incentive fliers continued to buckle their safety belts at a time when fliers were not distributed. Furthermore, the amount of this demonstrated generalization was generally a direct function of the number of prior rewards (up to four).

We studied maintenance of the belt use response by categorizing drivers according to the number of incentive fliers they had received, and then examining belt use over consecutive morning and afternoon observations

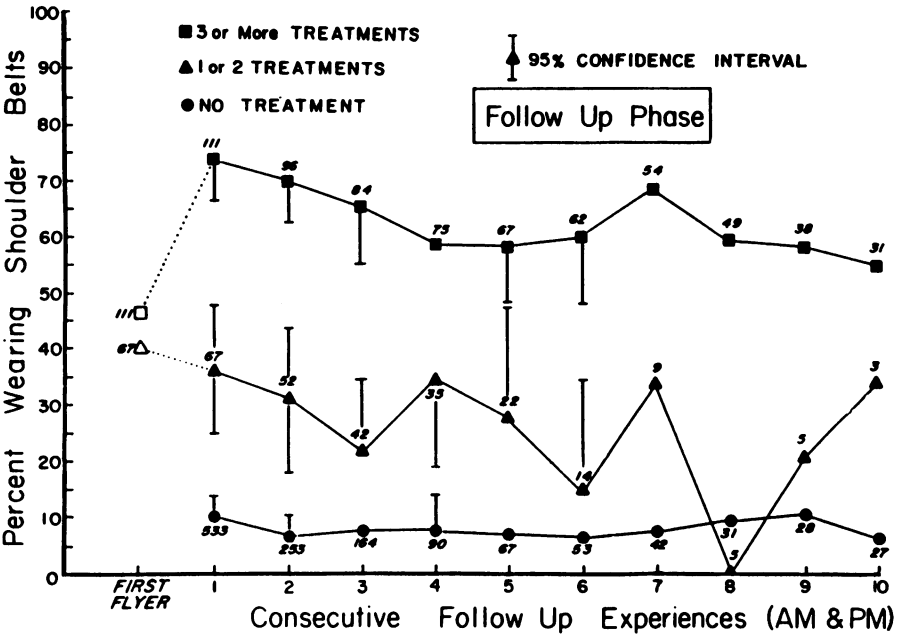

Fig. 21. Percentages of shoulder belt users over consecutive follow-up observations at Radford Army Plant as a function of number of flyers received during the intervention phase. Reproduced by permission from Geller, E.S.: Rewarding safety belt usage at an industrial setting: Tests of treatment generality and response maintenance. *J. Appl. Behav. Anal. 16*:198, 1983.

during follow–up (i.e., after the incentive/reward program had been terminated). Belt use during follow-up as a function of prior rewards for belt wearing revealed a clear grouping of the data with regard to response maintenance. That is, drivers who had received three or more rewards during the incentive phase showed substantially more safety belt use during follow-up than drivers who had received only one or two rewards; and those drivers with one or two reward experiences were more likely to be buckled up during follow-up than drivers who had not received any incentive flier for belt use.

Figure 21 depicts this relationship between intervention experience and safety belt use during follow-up observations. The initial data point for the two treatment groups (i.e., drivers who received at least one reward) depicts safety belt use at a time when these drivers received their first incentive flier, and thus serves as a control point for examining treatment durability. The safety belt use of these two groups was not significantly different when the first incentive flier was received; but for five of the first six occasions these drivers were observed during follow-up, those who had received three or more rewards were significantly more likely to be wearing their safety belt

than drivers who had received one or two rewards during the treatment phase ($p<0.05$). Actually, only the drivers who received three or more rewards for belt use showed substantial response maintenance over the follow-up phase.

Although other evaluations of incentive/reward programs for safety belt promotion have not been nearly as detailed as the one summarized above, the overall results are typical.[9,11,12,14] That is, whether implemented at industrial sites,[13,15,16] shopping malls,[17] bank exchange windows,[18,19] high schools,[20] or universities,[7,21,22] incentive/reward programs for safety belt promotion have at least doubled baseline levels of belt use. Although belt use has dropped substantially after the removal of incentive/reward programs, in most cases the post-treatment follow-up levels of belt use have been significantly higher than the pretreatment baseline usage. It is noteworthy, however, that all of these safety belt programs were implemented in settings with relatively low baseline levels of belt use (i.e., less than 25% of the vehicle occupants buckled up). It is possible that the impact of an incentive/reward program will be much less in a setting with high baseline levels of safety belt use. Such is the case in settings (e.g., countries, states, or armed service bases) where safety belt use is required by law or policy. This was the empirical question studied in the final experiment summarized in this presentation.

A Reward vs. A Punishment Approach

Throughout the Summer of 1986, Kalsher, Geller, Clarke, and Lehman [23] implemented and evaluated two safety belt programs on two large navy bases in Norfolk, Virginia: the Norfolk Naval Base and the Little Creek Naval Amphibious Base. The Norfolk Navy Base is the largest naval base in the world, with approximately 75,000 vehicles entering the base daily. Each day approximately 46,000 vehicles enter the Little Creek Naval Amphibious Base. Both navy bases had a long–standing safety belt use requirement for all vehicle occupants traveling on base. Signs near the entrances of each base conveyed the message "Safety Belt Use Required On Base."

Baseline observations of safety belt use were taken on each base at the main gates during morning arrival and afternoon departure and at busy intersections on base. After eight weeks of baseline observations, a "direct and delayed" incentive/reward program was implemented for four weeks at the Norfolk Navy Base. The theme of this program was "Get Caught Buckled Up" and involved the base police in recording the license plate numbers of vehicles with drivers using their shoulder belts. These license plate numbers were entered in weekly public drawings where valuable prizes donated by local merchants were raffled off. Winners were listed in the base newspaper.

Special inserts in the base newspaper announced this reward program, and provided a buckle-up pledge card that participants could hang from their inside rear-view mirror in order to be more readily noticed by the base police. The message on this pledge card, which was visible from outside the vehicle was, "Catch me... I buckle up." This program received much media attention from local newspapers, radio, and television.

After nine weeks of baseline observations on the Little Creek Base, a special disincentive/punishment approach to safety belt promotion was implemented. The base newspaper (as well as the local news media) announced the four–week "crackdown" on nonusers of safety belts. The theme of this program was "Don't Get Caught Unbuckled," and special newspaper inserts included a buckle up pledge card that could be hung on vehicles' inside rear-view mirror and portray the message, "Don't catch me... I buckle up." The advertised consequence for being caught unbuckled was the loss of base driving privileges.

Figure 22 depicts the percentage of drivers using safety belts on each naval base before, during, and after the special safety belt promotion programs. The graphed data points reflect a total of 128,799 vehicle observations. At both bases safety belt use was consistently higher during arrival at the entrance gate than during on-base or exit travel. This difference was apparently due to the presence of a marine guard only at the entrance gates. Indeed, the marine guard at the Little Creek Base entrance gates probably caused the dramatic increase in arrival safety belt use to a mean of 93.1% (n=8,437) during the disincentive program. This was the only case when one approach to safety belt promotion (i.e., the disincentive strategy) was more effective than the other (i.e., the incentive approach). For on base and departure travel, the incentive and disincentive programs influenced equivalent increases in safety belt use that were significant ($p<0.01$). Also, the levels of belt use during withdrawal and follow–up observations showed similar residual effects of both interventions. Thus, both an incentive and disincentive program increased safety belt use significantly ($p<0.01$) above relatively high baseline levels, and showed long-term impact after the programs were withdrawn. The disincentive approach produced more behavior change only when an enforcement official was on hand.

SUMMARY

This paper reviews a variety of techniques that can increase the large-scale use of vehicle safety belts. Activator approaches or behavior change strate-

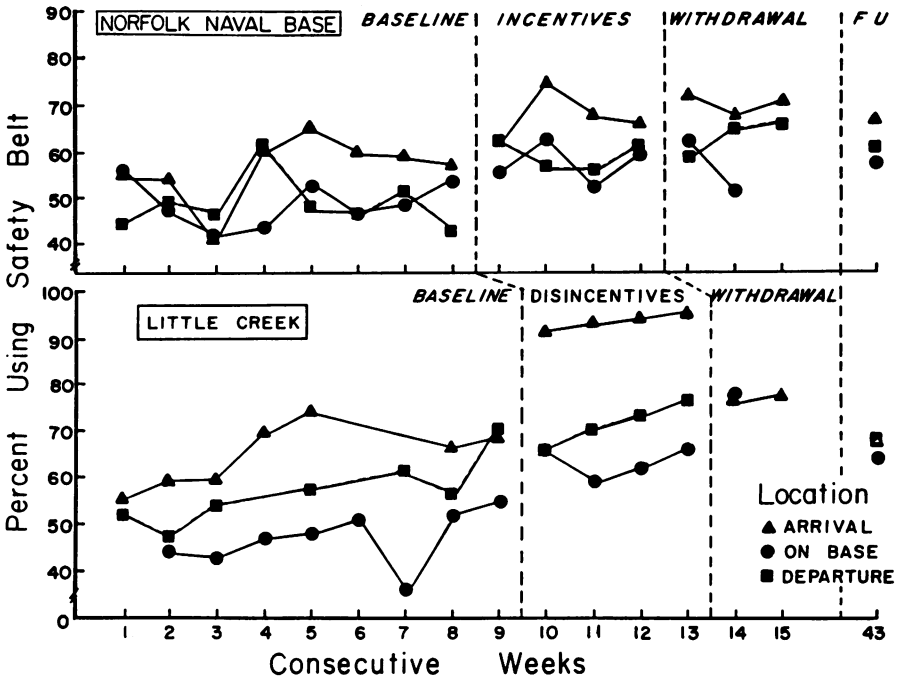

Fig. 22. The percentage of drivers observed using a safety belt at three survey sites on the Norfolk Navy Base and Little Creek Naval Amphibious Base during and after an incentive/reward or a disincentive/punishment safety belt program.

gies that precede opportunities to buckle up included: reminder techniques (i.e., buckle-up dashboard stickers, sound-light reminder systems in vehicles, and special "Airline Lifesaver" and "Flash for Life" prompting procedures), role modeling by television stars, educational tactics involving young school children, commitment pledgecard signing, incentives, and disincentives. Incentives and disincentives implicate contrasting consequences (i.e., rewards for buckling up versus punishers for not buckling up).

Reward strategies can be direct and immediate, direct and delayed, or indirect. These three different techniques for delivering rewards have been equivalently effective at increasing safety belt use in corporate and community settings. Examples of each of these reward procedures were presented, as well as a detailed behavior analysis of one particular corporate program that evaluated generalization and maintenance effects of direct and immediate rewards for safety belt use. Although the incentive/reward approach has more than doubled safety belt use in a variety of settings (e.g., high schools,

shopping malls, universities, banks, and industries), only one study has examined the impact of an incentive/reward program when the preprogram baseline level of belt use was above 25%. This program also compared an incentive/reward approach with an opposite disincentive/punishment procedure. The result showed that both approaches increased safety belt use above the 50% baseline levels that had been established by a safety belt use mandate. The disincentive approach was only superior to incentives when an enforcement offical was available.

The conclusion is that a number of strategies are cost effective for increasing safety belt use on a large scale, and no single approach is sufficient. Thus, a comprehensive nationwide application of both activators and consequences for safety belt promotion is recommended in order to support the buckle–up norm that has been established by the growing number of safety belt use mandates across the United States.

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